WHAT IS CLAIMED IS:

1. A method of forming a contact, comprising the steps of:

depositing a source gas comprising an undesirable component onto a substrate to fill a contact hole;

removing excess material from the substrate to form the contact in the contact hole; and

heating the contact in a reactive gas to remove at least a portion of the undesirable component from the contact.

2. The method of Claim 1, wherein the step of heating the contact is with a rapid thermal anneal process.

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3. The method of ~~Claim~~ Claim 1, wherein the step of removing the excess material is by chemical mechanical polishing.

4. The method of Claim 1, wherein the undesirable component comprises chlorine.

5. The method of Claim 1, wherein the source gas comprises a chlorine-containing precursor, and the undesirable component comprises chlorine.

6. The method of Claim 5, wherein the chlorine-containing precursor comprises $TiCl_4$.

7. The method of Claim 5, wherein the reactive gas comprises a nitrogen-containing gas.

8. The method of Claim 7, wherein the reactive gas comprises ammonia.

9. The method of Claim 5, wherein the contact comprises titanium nitride, the chlorine-containing precursor comprises titanium, and the source gas further comprises ammonia.

10. The method of Claim 9, wherein the contact comprises boron-doped titanium nitride, and the source gas further comprises borane.

11. A method of forming a contact, comprising the steps of:

depositing a source gas comprising a chlorine-containing precursor onto a substrate to fill a contact hole;

removing excess material from the substrate to form the contact in the contact hole; and

heating the contact in a nitrogen-containing gas to remove chlorine from the contact.

12. The method of Claim 11, wherein the step of heating the contact is with a rapid thermal anneal process.

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13. The method of Claim 11, wherein the step of removing the excess material is by chemical mechanical polishing.

14. The method of Claim 11, wherein the chlorine-containing precursor comprises titanium, source gas further comprises ammonia, and the contact comprises titanium nitride.

15. The method of Claim 14, wherein the source gas further comprises borane, and the contact comprises boron-doped titanium nitride.

16. A method of forming a contact, comprising the steps of:

depositing a source gas comprising a titanium and chlorine-containing precursor onto a substrate to fill a contact hole;

removing excess material from the substrate to form the contact in the contact hole; and

heating the contact in a nitrogen-containing gas to remove chlorine from the contact.

17. The method of Claim 16, wherein the step of heating the contact is with a rapid thermal anneal process.

18. The method of Claim 16, wherein the source gas further comprises an ammonia precursor to form titanium nitride.

Express Mail No. EL810084554US.
Attorney Docket MTI-31533
MICRON 00-1173
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19. The method of Claim 16, wherein the titanium and chlorine-containing precursor comprises $TiCl_4$.

20. The method of Claim 18, wherein the source gas further comprises a borane precursor to form boron-doped titanium nitride.

21. The method of Claim 16, wherein the nitrogen-containing gas comprises ammonia.

22. A method of forming a contact, comprising the steps of:

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depositing a source gas comprising a titanium and chlorine-containing precursor onto a substrate to fill a contact hole; the titanium and chlorine-containing precursor comprising $TiCl_4$;

removing excess material from the substrate to form the contact in the contact hole; and

thermally annealing the contact in a nitrogen-containing gas to remove chlorine from the contact; the nitrogen-containing gas comprising ammonia.

23. The method of Claim 22, wherein the step of thermally annealing the contact is by rapid thermal anneal at a temperature of at least 700°C.

24. The method of Claim 22, wherein the source gas further comprises an ammonia precursor to form titanium nitride.

25. The method of Claim 24, wherein the source gas further comprises a borane precursor to form boron-doped titanium nitride.

26. A method of forming a contact, comprising the steps of:

forming a titanium silicide layer over a substrate and within a contact hole;

depositing a titanium nitride layer onto the titanium silicide layer and to fill the contact hole by combining a titanium and chlorine-containing precursor with a nitrogen-containing precursor to form titanium nitride;

removing excess material from the substrate to form the contact in the contact hole; and

thermally annealing the contact in a nitrogen-containing gas to remove chlorine from the contact.

27. The method of Claim 26, wherein the step of thermally annealing the contact is by rapid thermal anneal at a temperature of 700°C. or greater.

28. The method of Claim 26, wherein the step of depositing the titanium nitride layer comprises combining $TiCl_4$ and NH_3 in a thermal chemical vapor deposition.

29. The method of Claim 26, wherein the step of depositing the titanium nitride layer further comprises combining the precursors with a B_2H_6 precursor to form boron-doped titanium nitride.

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30. A method of forming a contact, comprising the steps of:

forming a titanium silicide layer over a substrate and within a contact hole;

depositing a boron-doped titanium nitride layer onto the titanium silicide layer and to fill the contact hole by combining a titanium and chlorine-containing precursor with a nitrogen-containing precursor and a borane precursor to form boron-doped titanium nitride;

removing excess material from the substrate to form the contact in the contact hole; and

thermally annealing the contact in a nitrogen-containing gas to remove chlorine from the contact.

31. The method of Claim 30, wherein the step of thermally annealing the contact is by rapid thermal anneal at a temperature of 700°C. or greater.

32. The method of Claim 30, wherein the step of depositing the boron-doped titanium nitride layer comprises combining $TiCl_4$, NH_3, and B_2H_6 in a thermal chemical vapor deposition.

33. A method of forming a conductive contact on a semiconductor substrate comprising an opening through an insulative layer, the opening having sidewalls and extending to an underlying silicon-comprising substrate, the method comprising the steps of:

forming a titanium silicide layer over the insulative layer and within the opening;

depositing a source gas over the titanium silicide layer overlying the insulative layer and within the opening to form a layer comprising titanium nitride; the source gas comprising a chlorine-containing precursor;

removing excess of the layers overlying the insulative layer to form the contact within the opening; the contact having a concentration of chlorine; and

subjecting the contact to a heat treatment in a nitrogen-containing gas to reduce the concentration of chlorine within the contact.

34. The method of Claim 33, wherein the step of subjecting the contact to the heat treatment is with a rapid thermal anneal.

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35. The method of Claim 33, wherein the contact is subjected to a heat treatment is at a temperature of at least 700°C.

36. The method of Claim 33, wherein the step of forming the titanium silicide layer is by plasma enhanced chemical vapor deposition of a titanium precursor with a silicon precursor to form titanium silicide.

37. The method of Claim 33, wherein the step of depositing the source gas to form the titanium nitride layer is with thermal chemical vapor deposition.

38. The method of Claim 33, wherein the source gas comprises a titanium and chlorine-containing precursor and a nitrogen-containing precursor to form titanium nitride.

39. The method of Claim 38, wherein the source gas further comprises a borane precursor to form a boron-doped titanium nitride contact.

40. The method of Claim 33, wherein the step of subjecting the contact to a heat treatment reduces the chlorine concentration of the contact by at least about 50% by wt.

41. The method of Claim 33, wherein the step of subjecting the contact to a heat treatment reduces the chlorine concentration of the contact by at least about 75% by wt.

42. The method of Claim 33, wherein the step of subjecting the contact to a heat treatment reduces the chlorine concentration of the contact by at least about 95% by wt.

43. The method of Claim 33, wherein the chlorine concentration of the heat treated conductive contact is less than about 1% by wt.

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44. The method of Claim 33, wherein the chlorine concentration of the heat treated conductive contact is less than about 3% by wt.

45. The method of Claim 33, wherein the chlorine concentration of the heat treated conductive contact is less than about 4% by wt.

46. A method of forming a contact, comprising:

depositing a first source gas comprising $TiCl_4$, H_2, and SiH_4 precursors onto a substrate to form a titanium silicide layer in an opening;

depositing a second source gas comprising $TiCl_4$ and NH_3 precursors onto the titanium silicide layer to form a titanium nitride layer;

removing excess of the layers overlying the substrate by chemical mechanical polishing while maintaining the layers within the opening to form the contact; the contact having a concentration of chlorine; and

exposing the contact to a nitrogen-containing gas by thermal anneal to reduce the concentration of chlorine of the contact.

47. The method of Claim 46, wherein the nitrogen-containing gas comprises ammonia.

48. The method of Claim 46, wherein the thermal anneal is conducted at a temperature of at least 700°C.

49. The method of Claim 46, wherein the chlorine concentration of the thermally annealed contact is less than about 3% by wt.

50. A method of forming a contact, comprising:

depositing a first source gas comprising $TiCl_4$, H_2, and SiH_4 precursors onto a substrate to form a titanium silicide layer in an opening;

depositing a second source gas comprising $TiCl_4$, NH_3, and B_2H_6 precursors onto the titanium silicide layer to form a boron-doped titanium nitride layer;

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removing excess of the layers overlying the substrate by chemical mechanical polishing while maintaining the layers within the opening to form the contact; the contact having a concentration of chlorine; and

exposing the contact to a nitrogen-containing gas by thermal anneal to reduce the concentration of chlorine of the conductive contact.

51. The method of Claim 50, wherein the chlorine concentration of the thermally annealed conductive contact is less than about 3% by wt.

52. A method of forming a conductive contact in a semiconductor device comprising an opening through an insulative layer, the opening having sidewalls and extending to an underlying silicon-comprising substrate, the method comprising the steps of:

forming a layer comprising titanium silicide over the insulative layer and the substrate within the opening;

depositing a layer of boron-doped titanium nitride over the titanium silicide layer from a titanium and chlorine-containing precursor to fill the opening;

removing excess of the titanium nitride layer overlying the insulative layer while leaving the titanium nitride layer within the opening to form the contact; and

heat treating the contact to remove chlorine from the contact.

53. The method of Claim 52, wherein the opening has an aspect ratio of about 3:1 or greater.

54. The method of Claim 52, wherein the opening is about 0.25 μm or less.

55. The method of Claim 52, wherein the conductive contact has a thickness of about 200 angstroms or greater.

56. The method of Claim 52, wherein the conductive contact has a thickness of about 1000 to about 3000 angstroms.

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57. The method of Claim 52, wherein the step of depositing the boron-doped titanium nitride layer is by thermal chemical vapor deposition using a gaseous mixture comprising titanium tetrachloride, ammonia, and diborane.

58. The method of Claim 57, wherein the step of depositing the boron-doped titanium nitride layer is performed by flowing about 100 to about 500 sccm titanium tetrachloride, about 100 to about 1000 sccm ammonia, and about 100 to about 1000 sccm diborane over the substrate.

59. The method of Claim 52, wherein the titanium nitride layer comprises an amount of boron to substantially eliminate peeling of the contact from the sidewall of the opening and cracking of the insulative layer, and an amount of nitrogen to provide an effective amount of conductivity to an active area within the substrate.

60. The method of Claim 59, wherein the active area comprises a source or drain region.

61. The method of Claim 52, wherein the step of depositing the boron-doped titanium nitride layer comprises:

depositing a layer of titanium nitride over the titanium silicide layer;

depositing a layer of boron-doped titanium nitride over the titanium nitride layer; and

depositing a layer of titanium nitride over the boron-doped titanium nitride layer to fill the opening; and

repeating the foregoing steps to form a multi-layered film.

62. The method of Claim 52, wherein the step of depositing the boron-doped titanium nitride layer comprises depositing a layer of titanium nitride over the titanium silicide layer, and sequentially depositing overlying layers of boron-doped titanium nitride and titanium nitride to form a multi-layered film; the film comprising a boron-doped titanium nitride layer interposed between two titanium nitride layers.

63. The method of Claim 62, wherein each of the layers of the multi-layered film are about 100 to about 500 angstroms thick.

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64. The method of Claim 52, wherein the step of depositing the titanium silicide layer is by plasma enhanced chemical vapor deposition using a source gas comprising titanium tetrachloride and a silicon precursor.

65. The method of Claim 52, wherein the step of depositing the titanium silicide layer comprises the steps of sputtering titanium onto the substrate, and annealing the titanium.

66. A method of forming a conductive contact in an opening of a semiconductor substrate, the opening formed in an insulative layer and extending to an underlying silicon-comprising substrate, the opening defined by sidewalls and a bottom portion; the method comprising the steps of:

forming a layer comprising titanium silicide over the substrate and within the opening; and

depositing a boron-doped titanium nitride material over the titanium silicide layer and into the opening;

removing excess material from the substrate while leaving the titanium nitride material in the opening to form the contact; and

heating the contact in a nitrogen-containing gas to reduce the concentration of chlorine to less than about 3% by wt.;

wherein the conductive contact comprises an amount of boron to substantially eliminate peeling of the contact from the sidewall of the opening and cracking of the insulative layer, and an amount of nitrogen to provide an effective amount of conductivity to an active area within the substrate.

67. A method of forming a conductive contact in a semiconductor device comprising an opening through an insulative layer, the opening having sidewalls and extending to an underlying silicon-comprising substrate, the method comprising the steps of:

depositing a layer comprising titanium silicide over the insulative layer and the substrate within the opening; and

forming a titanium nitride layer over the titanium silicide by depositing a layer of titanium nitride over the titanium silicide layer; and sequentially depositing overlying layers of boron-doped titanium nitride and titanium nitride to fill the opening, wherein the boron-doped titanium nitride layer is interposed between two titanium nitride layers;

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removing excess material overlying the insulative layer while leaving the contact within the opening; the contact having a concentration of chlorine; and

heating the contact in a nitrogen-containing gas to reduce the concentration of chlorine to less than about 3% by wt.;

wherein the contact comprises an amount of boron to substantially eliminate peeling of the contact from the sidewall of the opening and cracking of the insulative layer, and an amount of nitrogen to provide an effective amount of conductivity to an active area within the substrate.

68. A method of forming a semiconductor device, comprising the steps of:

forming an insulative layer over a silicon-comprising substrate comprising an active area;

forming an opening in the insulative layer to expose the active area of the substrate, the opening having sidewalls;

forming a seed layer comprising titanium silicide over the insulative layer and the substrate within the opening; and

forming a layer comprising titanium nitride over the seed layer to fill the opening;

removing excess material overlying the insulative layer while leaving the contact within the opening; the contact having a concentration of chlorine; and

heating the contact in a nitrogen-containing gas to reduce the concentration of chlorine to less than about 3% by wt.

69. A method of forming a semiconductor device, comprising the steps of:

forming an insulative layer over a silicon-comprising substrate comprising an active area;

forming an opening in the insulative layer to expose the active area of the substrate, the opening having sidewalls;

forming a seed layer comprising titanium silicide over the insulative layer and the substrate within the opening; and

forming a layer comprising boron-doped titanium nitride over the seed layer to fill the opening;

removing excess material overlying the insulative layer while leaving the contact within the opening; the contact having a concentration of chlorine; and

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heating the contact in a nitrogen-containing gas to reduce the concentration of chlorine to less than about 3% by wt.;

whereby the contact comprises an amount of boron effective to provide the contact with a level of adhesion to the insulative layer within the opening to substantially eliminate peeling of the contact from the sidewalls of the opening, and a level of thermal stress to substantially eliminate cracking of the insulative layer; and an amount of nitrogen effective to maintain the conductivity of the contact at a predetermined level for an effective electrical contact with the active area.

70. A method of forming a semiconductor device, comprising the steps of:

forming an insulative layer over a silicon-comprising substrate comprising a conductive area;

forming an opening in the insulative layer to expose the conductive area of the substrate, the opening having sidewalls;

forming a seed layer comprising titanium silicide over the insulative layer and the substrate within the opening; and

filling the opening with alternating layers of titanium nitride and boron-doped titanium nitride material;

removing excess material overlying the insulative layer while leaving the contact within the opening; the contact having a concentration of chlorine; and

heating the contact in a nitrogen-containing gas to reduce the concentration of chlorine to less than about 3% by wt.;

wherein the boron-doped titanium nitride layer is interposed between two titanium nitride layers, and the boron-doped titanium nitride layer comprises an amount of boron effective to provide the conductive contact with a level of adhesion to the insulative layer within the opening to substantially eliminate peeling of the conductive contact from the sidewalls of the opening, and a level of thermal stress to substantially eliminate cracking of the insulative layer; and an amount of nitrogen effective to maintain the conductivity of the contact at a predetermined level for an effective electrical contact with the conductive area.

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71. A method for filling high aspect ratio contact openings, comprising the steps of:

providing a substrate having a silicon-comprising substrate and an insulative layer formed thereon, the insulative layer having a surface and at least one contact opening formed therein to the substrate; the contact opening having an aspect ratio of at least 3:1;

forming a seed layer comprising titanium silicide over the insulative layer and the surface of the substrate within the contact opening; and

forming a titanium nitride film over the seed layer;

removing excess material overlying the insulative layer while leaving the contact within the opening; the contact having a concentration of chlorine; and

heating the contact in a nitrogen-containing gas to reduce the concentration of chlorine to less than about 3% by wt.

72. A method for filling high aspect ratio contact openings, comprising the steps of:

providing a substrate having a silicon-comprising substrate and an insulative layer formed thereon, the insulative layer having a surface and at least one contact opening formed therein to the substrate; the contact opening having an aspect ratio of at least 3:1;

forming a seed layer comprising titanium silicide over the insulative layer and the surface of the substrate within the contact opening; and

forming a boron-doped titanium nitride film over the seed layer;

removing excess material overlying the insulative layer while leaving the contact within the opening; the contact having a concentration of chlorine; and

heating the contact in a nitrogen-containing gas to reduce the concentration of chlorine to less than about 3% by wt.

73. A method for filling high aspect ratio contact openings, comprising the steps of:

providing a substrate having a silicon-comprising substrate and an insulative layer formed thereon, the insulative layer having a surface and at least one contact opening formed therein to the substrate; the contact opening having an aspect ratio of at least 3:1;

forming a seed layer comprising titanium silicide over the insulative layer and the surface of the substrate within the contact opening; and

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forming a multi-layered film over the seed layer, the film comprising a layer comprising boron-doped titanium nitride interposed between two layers comprising titanium nitride layer;

removing excess material overlying the insulative layer while leaving the contact within the opening; the contact having a concentration of chlorine; and

heating the contact in a nitrogen-containing gas to reduce the concentration of chlorine to less than about 3% by wt.

74. A conductive contact comprising thermally annealed titanium nitride disposed within a contact opening and in electrical contact with an active area, the contact comprising a chlorine concentration of less than about 3% by wt.

75. The conductive contact of Claim 74, comprising an amount of boron effective to provide the conductive contact with a level of adhesion to the sidewalls of the contact opening to substantially eliminate peeling of the contact from the sidewalls, and a level of thermal stress to eliminate cracking of an adjacent material layer; and an amount of nitrogen effective to maintain the conductivity of the contact at a predetermined level for an effective electrical contact with the active area.

76. The conductive contact of Claim 74, wherein the contact opening has an aspect ratio of 3:1 or greater.

77. The conductive contact of Claim 74, wherein the contact opening has a width of about 0.25 μm or less.

78. The conductive contact of Claim 74, wherein the conductive contact is selected from the group consisting of a local interconnect, contact, buried contact, via, plug, and filled trench.

79. The conductive contact of Claim 74, wherein the conductive contact has a thickness of about 200 angstroms or greater.

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80. The conductive contact of Claim 74, wherein the conductive contact has a thickness of about 1000 to about 3000 angstroms.

81. The conductive contact of Claim 74, wherein the contact is disposed on a titanium silicide layer overlying the substrate within the opening.

82. The conductive contact of Claim 75, comprising the boron-doped titanium nitride layer interposed between two layers comprising undoped titanium nitride.

83. The conductive contact of Claim 75, comprising multiple overlying layers of boron-doped titanium nitride and undoped titanium nitride, the boron-doped layer interposed between the undoped titanium nitride layers.

84. The conductive contact of Claim 83, wherein each of the layers of the conductive contact are about 100 to about 500 angstroms thick.

85. A conductive contact of a semiconductor device, the conductive contact disposed within an opening having sidewalls and extending through an insulative layer to an underlying silicon-comprising substrate comprising an active area; the contact comprising thermally annealed, boron-doped titanium nitride overlying a layer of titanium silicide disposed on the silicon-comprising substrate; the contact

comprising a chlorine concentration of less than about 3% by wt., and an amount of boron effective to provide the conductive contact with a level of adhesion to the insulative layer within the opening to substantially eliminate peeling of the conductive contact from the sidewalls of the opening, and a level of thermal stress to substantially eliminate cracking of the insulative layer; and an amount of nitrogen effective to maintain the conductivity of the contact at a predetermined level for an effective electrical contact with the active area.

86. The conductive contact of Claim 85, wherein the contact opening has an aspect ratio of 3:1 or greater.

87. The conductive contact of Claim 85, comprising the boron-doped titanium nitride layer interposed between two layers comprising undoped titanium nitride.

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88. The conductive contact of Claim 85, comprising multiple overlying layers of boron-doped titanium nitride and undoped titanium nitride, the boron-doped layer interposed between the undoped titanium nitride layers.

89. The conductive contact of Claim 85, wherein the conductive contact is selected from the group consisting of a local interconnect, contact, buried contact, via, plug, and filled trench.

90. The conductive contact of Claim 85, wherein the conductive contact has a thickness of about 1000 to about 3000 angstroms.

91. A semiconductor circuit, comprising:

a conductive contact comprising thermally annealed titanium nitride having a chlorine concentration of less than about 3% by wt., and disposed within a contact opening extending through an insulative layer to an underlying silicon-comprising substrate of a semiconductor device, a layer comprising titanium silicide overlying the silicon-comprising substrate; the contact opening defined by sidewalls.

92. A semiconductor circuit, comprising:

a conductive contact comprising thermally annealed boron-doped titanium nitride having a chlorine concentration of less than about 3% by wt., and disposed within a contact opening extending through an insulative layer to an underlying silicon-comprising substrate of a semiconductor device, a layer comprising titanium silicide overlying the silicon-comprising substrate; the contact opening defined by sidewalls; wherein the contact comprises an amount of boron effective to provide the contact with a level of adhesion to the insulative layer within the opening to substantially eliminate peeling of the conductive contact from the sidewalls of the opening, and a level of thermal stress to substantially eliminate cracking of the insulative layer; and an amount of nitrogen effective to maintain the conductivity of the contact at a predetermined level for an effective electrical contact with an active area within the substrate.

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93. The semiconductor circuit of Claim 92, wherein the contact opening has an aspect ratio of 3:1 or greater.

94. The semiconductor circuit of Claim 92, wherein the conductive contact has a thickness of about 1000 to about 3000 angstroms.

95. The semiconductor circuit of Claim 92, wherein the contact comprises overlying layers of boron-doped titanium nitride and undoped titanium nitride, the boron-doped layer interposed between the undoped titanium nitride layers.

96. An integrated circuit memory device, comprising:

an array of memory cells;

internal circuitry; and

at least one generally vertical contact coupled to the memory array and internal circuitry, the contact comprising thermally annealed titanium nitride disposed within a contact opening over a titanium silicide layer overlying a silicon-comprising conductive area of a memory array, the contact having a chlorine concentration of less than about 3% by wt., whereby the opening is defined by sidewalls.

97. An integrated circuit memory device, comprising:

an array of memory cells;

internal circuitry; and

at least one generally vertical contact coupled to the memory array and internal circuitry, the contact comprising thermally annealed boron-doped titanium nitride disposed within a contact opening over a titanium silicide layer overlying a silicon-comprising conductive area of a memory array, the contact having a chlorine concentration of less than about 3% by wt., whereby the opening is defined by sidewalls, and the conductive contact comprises an amount of boron effective to provide a level of adhesion of the conductive contact to the insulative layer to substantially eliminate peeling of the conductive contact from the sidewalls of the opening and cracking of the insulative layer, and an amount of nitrogen effective to maintain the conductivity of the contact at a predetermined level for an effective electrical contact with the conductive area of the memory array.

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98. The memory device of Claim 97, wherein the conductive area comprises a source/drain of a transistor.

99. An integrated circuit memory device, comprising:

an array of memory cells;

internal circuitry; and

at least one generally vertical thermally annealed contact coupled to the memory array and internal circuitry, the contact comprising alternating layers of titanium nitride and boron-doped titanium nitride disposed within a contact opening over a titanium silicide layer overlying a silicon-comprising an active area of a memory array, the boron-doped titanium nitride layer disposed between two layers of titanium nitride; whereby the opening is defined by sidewalls, and the contact comprises an amount of boron effective to provide a level of adhesion of the contact to the insulative layer to substantially eliminate peeling of the contact from the sidewalls of the opening and cracking of the insulative layer, and an amount of nitrogen effective to maintain the conductivity of the contact at a predetermined level for an effective electrical contact with the active area of the memory array; and the contact having a chlorine concentration of less than about 3% by wt.

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100. The memory device of Claim 99, wherein the active area comprises a source/drain of a transistor.